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BULLETIN DU MUSÉUM NATIONAL D'HISTOIRE NATURELLE
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Preliminary descriptions of Indian earthworms (Megascolecidae : Oligochaeta) from the Palni Hills

by B. G. M. Jamieson *

Résumé. — *Descriptions préliminaires de Vers de terre (Megascolecidae : Oligochaetes) des collines de Palni (Indes).*

Huit espèees de Vers de terre des eollines de Palni (Indes), dont l'une appartient à un nouveau genre, sont déerites : *Diporochaeta dorsochaeta* n. sp., *D. macrochaeta simpliciseta* n. s.sp., *Celeriella bursata* n. sp. et *C. punctata*, n. sp., *C. quadripapillata* Stephenson, 1924, *Troyia gundarshola* n. gen. et n. sp., *Lampito bouchei* n. sp. et *L. sylvicola* Michaelsen, 1907. Les diagnoses des genres sont données ainsi que des elés diehotomiques pour les espèees des genres *Celeriella* et *Lampito*. Toutes les espèees orientales attribuées jusqu'à présent au genre *Plutellus* sont transférées dans le genre *Diporochaeta* qui néeessite une nouvelle étude. Le genre *Celeriella* présente des rangées transversales de néphrostomes préseptaux au lieu de la paire médiane qui lui avait été attribuée préeédemment.

Abstract. — Eight speeies of earthworms from the Palni Hills ineluding a new genus, are deseribed : *Diporochaeta dorsochaeta* sp. nov., *Diporochaeta macrochaeta simpliciseta* subsp. nov., *Celeriella bursata* and *C. punctata* spp. nov., *C. quadripapillata* Stephenson, 1924, *Troyia gundarshola* gen. et sp. nov., *Lampito bouchei* sp. nov. and *L. sylvicola* Michaelsen, 1907. Their respective genera are defined and keys to the speeies of *Celeriella* and *Lampito* are given. All Oriental speeies formerly assigned to *Plutellus* are transferred to *Diporochaeta* but the latter genus requires further analysis. *Celeriella* is shown to have transverse rows of preseptal nephrostomes, not the median pair previously attributed to the genus.

Introduction

Eeologieal studies eondueted by Professor J. P. Troy in the Palni Hills of South India have yielded nine speeies of earthworms of whieh one, *Moniligaster troyi* is deseribed elsewhere (Jamieson, 1976*b*) and eight are the subjeet of this paper. It has been eoneluded (Troy, *in litt.*) that earthworms play a very important role in soil-forming proeesses of these hilly traets, in their fertility and even in the stability of their landseapes. Deseription of these worms is therefore of value not only to taxonomists abut lso to eeologists and pedologists working in the area.

The earthworms were eolleeted at five stations from longitude 77°16′27″ and 77°28′05″ E and latitude 10°08′21″ and 10°12′49″ N in the Palni Hills. Detailed deseriptions of the habitat will be presented by Professor Troy in a forthcoming publieation but abbreviated deseriptions are given here.

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Collecting locations in Palni Hills

Station 1. — South India, border between Kerala State and Tamilnadu, 77° 16′27″ E 10° 08′21″ N, altitude 2 490 m, Vandaravu Range, topography hilly, summit of a local dome. Temperature : mean annual 13°C, amplitude (annual) 4-5°C, daily up to 40°C within the grass cover ; frost frequent ; rainfall annual average 1 400 mm ; fog frequent ; dry season 2-3 months (December-February). Vegetation *Pollinia phaeotrix* and *Arundinella vaginata* + hygrophytes, low savanna (montane grassland), probably climax ; trees and shrubs absent from grass cover ; fire regular each year (January, February). Rock types intermediate to acid charnockites traversed by quartz and pegmatite veins, and enderbite. Soil montane humic ferrallite (with highly organic upper horizons, up to 25 % organic matter in top soil, well associated), typic gibbsihumox humic ferralsol ; pH (upper horizon) 4.9 ; water 1/2.5.

Station 2. — Talmilnadu, 77° 25′46″ E 10° 11′08″ N, altitude 2 350 m, top of southern great cliff, along road Kodaikanal-Munnar, 15 km WSW of Kodaikanal, topography hill slope (30 %). Temperature : mean annual 16°C, amplitude annual 3-4°C, daily up to 50°C within the grass cover ; frost frequent ; rainfall annual average 1 400 mm ; fog moderately frequent ; dry season 3-4 months (December-April). Vegetation *Chrysopogon zeylanicus* and *Arundinella vaginata* savanna, with various small trees and shrubs (typical montane savanna) ; fire regular, each year during dry season. Rock type intermediate to acid charnockite. Soil montane intergrade between humic ferralite and ferralitic with gibbsite soils ; highly organic (up to 30 % organic matter) top soil, well decomposed and associated, typic humic gibbsihumox, humic ferralsol ; pH (upper horizon) 5.3 ; water 1/2.5.

Station 3. — Tamilnadu, 77° 26′37″ E 10° 12′49″ N, altitude 2 270 m, central Palni-Gundar Basin, 3 km W of Kodaikanal Observatory, topography moderate hill slope (18 %). Temperature : mean annual 15°C, amplitude annual 3°C, daily < 10°C under tree cover ; rainfall annual average 1 300 mm ; dry season 3-4 months (December-April) ; frost nil under tree cover. Vegetation : old blue gum plantation (1920), *Eucalyptus globulus*, pure dense. Rock type intermediate charnockite (highly metamorphic hornblende-hypersthene gneiss). Soil montane humic ferrallitic soil with gibbsite with moder-mor top horizon, humic gibbsihumox, ferralsol ; pH (top horizon) 4.4 ; water 1/2.5

Station 4. — Tamilnadu, 77° 28′05″ E 10° 12′21″ N, altitude 2 285 m, Kodaikanal golf links near pillar rocks, 5 km S of Kodaikanal ; topography gentle slope. Temperature : annual mean 16°C, amplitude annual 3-4°C, daily up to 15°C at soil level ; rainfall annual average 1 300/1 500 mm ; dry season 2-3 months ; frost possible under trees during cool season. Vegetation old pine plantation (exotic), *Pinus radiata* (1920) with understorey of exotic Acacias, *A. dealbata*, *A. mearnsii*, *A. melanoxylon* ; cover 0.6-0.7. Rock : jointed (orthogonal joints) intermediate charnockite. Soil montane ferrallitic with gibbsite soil with moder-mor top horizon, humic gibbsihumox, ferralsol ; PH (upper horizon) 4.1 ; water 1/2.5.

Station 5. — Tamilnadu, " Gundar Shola ", Gundar Basin, Central Palni, 77° 26′13″ E 10° 12′46″ N, altitude 2 100 m ; topography steep slope, northern aspect. Temperature : annual mean 15°C ; amplitude annual 2-3°C ; daily < 10°C under forest ; rainfall annual average 1 300-1 400 m ; dry season 3-4 months ; frost nil under tree cover. Vegetation natural forest, montane evergreen low forest dominated by Lauraceae, Elaeocarpaceae, Myrtaceae, Icacinaceae, etc. ; very little disturbed. Rock type intermediate to acid charnoekite. Soil forest montane ferrallitic with gibbsite soil, with well associated organic matter to a depth of 120 cm, humic gibbsihumox, ferralsol ; pH (upper horizon) 6.3 ; water 1/2.5.

Distribution of species
(+ = present)

	Stations 1	2	3	4	5
Moniligaster troyi Jamieson, 1976*b*	+				
Diporochaeta dorsochaeta sp. nov.		+		+	+
Diporochaeta macrochaeta simpliciseta subsp. nov.	+				
Celeriella bursata sp. nov.	+				
Celeriella punctata sp. nov.					+
Celeriella quadripapillata Stephenson, 1924		+	+		
Troyia gundarshola gen. et sp. nov.				+	+
Lampito bouchei sp. nov.	+				
Lampito sylvicola Michaelsen, 1907.					+

Tribe PERIONYCHINI Jamieson, 1971*a*

Genus **DIPOROCHAETA** Beddard, 1890

Setae 8 or more per segment. A pair of combined pores of vasa deferentia and tubular or tubuloracemose (rarely racemose ?) prostates on XVIII. Last hearts in XII or XIII, typically those in XII posteriad latero-oesophageal ; subneural vessel absent. Gizzard in V or VI (well developed to vestigial) ; typhlosole absent or exceptionally present (rudimentary to well developed). Extramural calciferous glands usually absent, rarely with paired glands in X and XI (type-species) or XI and XII or unpaired annular glands in XV. Nephridia stomate, exonephric holonephridia with or without bladders ; their pores in straight or sinuous lines but never with regular alternation ; the anterior nephridia sometimes tufted ; rarely (*dorsochaeta*) with two at least caudally stomate nephridia on each side per segment. Spermathecae 1-5, pretesticular, diverticulate, paired or rarely (*palniensis*) median unpaired ; diverticulum usually single, uniloculate, rarely paired, exceptionally composite, never sessile multiloculate.

Distribution : New Zealand (type-species) and neighbouring islands. Eastern Subregion of Australia. India. Ceylon. Burma.

Type species : *Perichaeta intermedia* Beddard, 1889.

Remarks

The above brief diagnosis of *Diporochaeta* is modified from Jamieson (1976*a*), where a detailed description and a discussion of the genus are given, to allow inclusion of oriental species hitherto assigned to the purely Australian genus *Plutellus*. The sole distinction between the classical *Plutellus* and *Diporochaeta*, the perichaetine condition of the latter and the lumbricine condition of the former, has been shown in the work cited tol ack significance. American " plutelli " are referable to *Argilophilus* Eisen which is not clearly

separable from *Diporochaeta* but appears to differ notably in the absence of extramural spermathceal divertieula. Ineorporation of oriental speeies, including the two aberrant species described below (*D. macrochacta* and *D. dorsochaeta*) has necessitated the emendments to the generic diagnosis for the following features : the typhlosole may be well developed ; nephridia are rarely replicated (*D. dorsochaeta*) ; and spermatheeae may be unpaired.

Restriction of *Plutcllus* to speeies which, like the type-speccis, have the three apomorph characters well developed extramural calciferous glands in X-XIII in combination with vesiculate nephridia and regular alternation of nephropores (JAMIESON, 1971*b*) has been formally recognized by JAMIESON and NASH (1976). While such restriction appears wholly justified, it must be noted that *Diporochacta* (with its possible junior synonym *Graliophilus*) is defined largely by the synplesiomorphy holonephridia with no regular alternation of nephropores (and in most species tubular prostates) and it possibly will be divisible into further genera by application of the principle of HENNIG that taxonomic groups should be recognized on the basis of shared advanced characters (synapomorphies). Such an analysis of *Diporochaeta* has in effect been commeneed by removal of *D. pellucida* Bourne Nilgiri Hills) to the monotypic *Priodochaeta* by GATES (1940). *P. pellucida* resembles *D. macrochaeta* in having tufted nephridia anteriorly and holonephridia caudally but differs in the apomorphy extramural calciferous glands (in XIV-XVI). The two species may be more closely related than they are to other members of the *Diporochaeta-Priodochaeta* complex.

A key to the previously known speeies of oriental *Diporochaetas* is given, under *Plutellus*, by GATES (1972).

Diporochaeta (?) **dorsochaeta** sp. nov.
(Fig. 2 B, C ; 5 E ; 6 E-G, K ; Table I)

Length 39,66 mm, width (midclitellum) 1.1, 1.4 mm, segments 110, 118 (H, P1). Prostomium epilobous, almost tanylobous, sides slightly convergent posteriad ; hind end clubbed. First dorsal pore 5/6. Setae commencing in II in 8 regular longitudinal rows throughout ; setae *d* displaced far dorsally, closer together than they are to *c* lines in all segments and at the two ends of the body conspicuously enlarged (H, P1) ; in *XII aa* : *ab* : *bc* : *cd* : *dd* averaging 1.9 : 1.0 : 1.8 : 2.1 : 1.2 ; *dd* : *u* = 0.07-0.13 (mean 1.2, 8 specimens). Nephropores not externally recognizable. Clitellum annular 1/2 XIII-XVI, weakly (H) to well developed 1/2 XIII-XVII (P2) ; at full development oceluding intersegments and dorsal pores ; setae retained. Male pores in *b* lines of XVIII relative to adjacent segments, on strongly protuberant papillae which greatly expand the setal annulus but leave free anterior and posterior bands of the segment ; each papilla preceded by an indistinct oval genital marking which reaches 17/18 (H, P2) or this marking not apparent (P1). Female pores a pair anteromedian ol setae *a* of XIV. Spermathecal pores 2 pairs of minute orifices, in 7/8 and 8/9, in *b* lines (H, P1).

Thickest septa 7/8-10/11, only moderately thickened (H). Dorsal blood vessel single not certainly traceable on and in front of the gizzard (H, P1) ; last hearts in XII ; those in X-XII arising from the supra-oesophageal and apparently also from the dorsal vessel (latero-oesophageal) ; supra-oesophageal small, in X-XII ; subneural vessel absent. Gizzard in VI, large and strongly muscular, globose (H) to cylindrical (P1) extending into VIII

by backward deflection of septa. Oesophagus lacking extramural calciferous glands but widened and with numerous high longitudinal radial lamellae in XIII and XIV (H) or XIV and XV (P1) or XIII, XIV, XV (P2). Intestine commencing in XVII (H), 1/2 XVII (P1), XVIII (P2) or XIX (H) if the portion in XVII and XVIII, which is more vascular than in XIX, be considered oesophageal; an internal constriction anteriorly in XVII is apparently the oesophago-intestinal valve, however; muscular thickening caeca and typhlosole absent. Nephridia : in the anterior intestinal region with two large nephridia on each side, discharging by a long slender duct presetally in *cd* and *b* respectively; the lateral nephridium with a (preseptal ?) funnel; no funnel demonstrated for the median nephridium. Two nephridia on each side in the forebody also. Caudally with this condition persisting but the lateral, stomate nephridium much enlarged; median preseptal funnel demonstrated for most caudal segments and in some segments a further lateral funnel, suggesting a simple *Celeriella* condition. Holandric; iridescent funnels in X and XI; testis-sacs absent; large, much divided seminal vesicles in IX and XII. Prostates one pair, depressed tubular in XVIII, the gland much contorted into a compact rounded or almost quadrangular mass, depressed and irregular in cross section chiefly owing to mutual distortion of adpressed coils; ectal duct slender and tortuous, though muscular; vas deferens joining the ental end of the duct (H, P1). Penial setae present : short and stout, almost tusklike, tapering to blunt points and with a few small apically directed teeth sparsely scattered over the apical sixth; a mature seta 237 µm long and at midlength, 11 µm wide. Ovaries, with several terminal strings of large oocytes, and funnels in XIII; small loculi in XIV may be ovisacs. Spermathecae two pairs in VIII and IX, each retort-shaped with ovoid ampulla and slender duct (H, P1), the ampulla recurved on the duct in the holotype; a short clavate diverticulum (inseminated in Stn 2 material) pendant laterally near the ental end of the duct.

Material examined : Stn 5 — holotype (Paris Museum AH 320); paratypes 6 and 7 (BJ 1976.5.3-4); paratype 8 (Paris Museum AH 321). Stn 2 — paratypes 4 and 5 (BJ 1976.5. 1-2). Stn 4 — paratypes 1-3 (Paris Museum AH 322).

Remarks

The affinities of this species appear ambivalent. It may be placed in the perionychin genus *Diporochaeta* (Acanthodrilidae sensu Gates) if duplication of the characteristic pair of nephridia in each segment is allowed in that genus. It may alternatively be assigned to the megascolecin genus *Celeriella* (Octochaetidae sensu Gates) on the grounds of tubular prostates, calciferous (?) lamellae in XIII-XV, and an albeit simple meronephric condition with replication of the preseptal nephrostomes. *Celeriella* is, however, a homogeneous genus especially with regard to the form of the prostates which extend through many segments and have the muscular duct extending through two or more segments, necessitating prolongation of the vas deferens well behind XVIII. It seems preferable, therefore, to associate this species with *Diporochaeta* (which absorbs all Indian species currently in *Plutellus*) regarding the duplication of the nephridia as a purely specific character of *D. dorsochaeta*. A similar replication occurs in the typically holonephric Australian genus *Diplotrema*. The validity of associating this species with *Diporochaeta* is indicated by its close

similarity to the purely holonephric *Diporochaeta (= Plutellus) campsiaulus*, also from Palni Hills. Similarities of *D. campsiaulus* include the epilobous prostomium ; first dorsal pore in 5/6 ; termination of the clitellum in XIII and XVII ; location of male and spermathecal pores in *b* lines ; the general form of the spermathecae and, most striking, the unusually dorsal displacement of the dorsal setae. Significant differences of *D. dorsochaeta* from *D. campsiaulus* are, however, the fact that *dd* is always less than *cd* (in the latter species changing from 3/4 *cd* in the midbody to 2.5 *cd* in the forebody), the presence of penial setae and the duplication of the nephridia.

Diporochaeta macrochaeta (Stephenson, 1925)

D. macrochaeta simpliciseta subsp. nov.

(Fig. 1 A ; 5 H ; 6 H ; Table I)

Length 80 + mm, width (midclitellum) 1.7 mm, 143 + segments (H ; all 7 specimens are posterior amputees). Prostomium proepilobous small, in all specimens withdrawn so as not to be dorsally visible. First dorsal pore (minute) 10/11. Setae in eight regular longitudinal rows as far as posterior amputation ; in XII *aa* : *ab* : *bc* : *cd* : *dd* : averaging 2.8 : 1.0 : 3.0 : 2.5 : 12.9 ; *dd* : *u* = 0.42-0.48 (mean 0.45, 5 specimens). Nephropores not externally recognizable. Clitellum not visible but intersegments 16/17 and 17/18 dorsally obscured in one specimen. Male pores well lateral of *b* lines of XVIII, relative to adjacent segments, on distinct oval papillae which are separated by a moat from a high, narrow tumid wall which encloses both papillae, extends laterally to *c* lines, slightly overhangs XIX and in the midline enters XVII, forming a median tumescence in that segment ; a median extension of the wall passing forward from its posterior border between the papillae to shortly anterior of the equator of XVIII. Female pores minute, shortly presetal in XIV, almost contiguous medianly. Spermathecal pores small protuberances into 7/8 and 8/9 from VIII and IX, in *a* lines.

Thickest septa 7/8-12/13, strongly thickened, with 7/8-9/10 the strongest ; all of these funnel-shaped. Dorsal blood vessel single, continuous onto the pharynx ; last hearts in XIII ; only those in X-XIII latero-oesophageal, each with a connective from dorsal and supra-oesophageal vessel ; supra-oesophageal in IX-XI as wide as the dorsal vessel, traceable but narrow in at least VIII and XII and XIII ; subneural vessel absent. Gizzard in V, very large, strongly muscular and broadly fusiform, extending into IX by displacement of septa. Oesophagus in XII-XVI darkly vascularized and segmentally swollen ; internally rugose, but extramural calciferous glands absent. Intestine commencing in XIX ; muscular thickening and caeca absent ; a deep laminate dorsal typhlosole starting almost imperceptibly in XXII ; intestine thicker wall in XXIV posteriorly. Nephridia in VI, VII and VIII (no nephridia seen anterior to this) forming increasingly large tufts lying dorsolaterally on the oesophagus and sending each a very long, conspicuous (composite ?) duct which enters the parietes at the anterior margin of the preceding segment in *cd*. Succeeding nephridia a small exonephric (meronephric ?) tuft on each side ; no funnels demonstrable ; ducts entering the parietes presetally in *cd* ; caudally with a pair of transversly elongate nephridia, each with a preseptal funnel, on each side which appear to

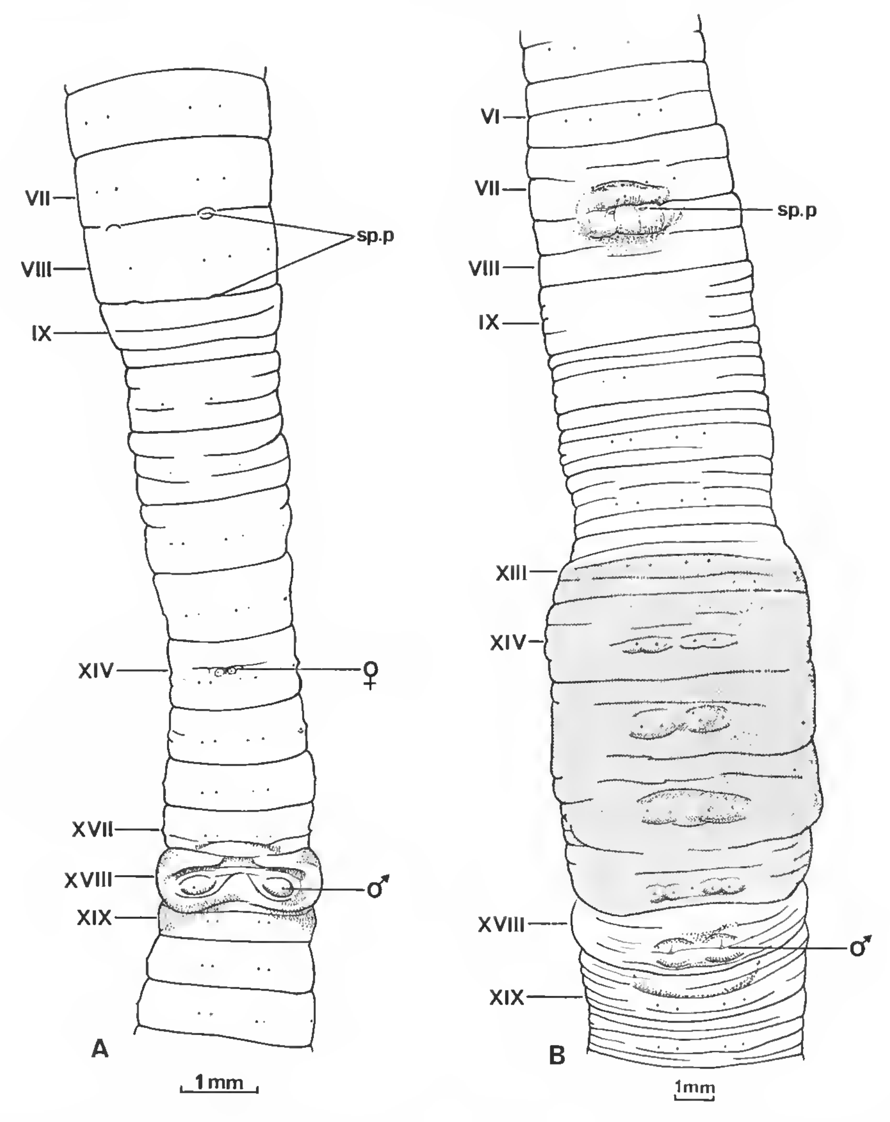


Fig. 1. — Genital fields. A, *Diporochaeta macrochaeta simpliciseta* subsp. nov. (holotype) ; B, ***Troyia*** *gundarshola* gen. et sp. nov. (holotype).

Abbreviations in figs. 1-6 : ♀, female pore ; g.m., accessory genital marking ; ♂, male pore ; p.s., penial seta ; pr.d., prostate duct ; pr. g., glandular part of prostate ; sem. gr., seminal groove ; sp.p., spermathecal pore ; t.pub., tubercula pubertatis ; v.d., vas deferens. Roman numerals are segment numbers. Clitellum shaded. All by camera lucida.

be holonephridia though each has several small spiral loops medianly, the duct long and very slender, entering the parietes presetally in *cd*. Metandric ; testes and iridescent sperm funnels in XI ; testis-sacs absent ; large racemose seminal vesicles in XII. Ovaries with several attenuated strings of large oocytes and funnels, in XIII ; ovisacs present (?).

Prostates tubular, much coiled in XVIII and XIX, the long convoluted muscular duct confined to XVIII and receiving the vas deferens at its ental third. Penial setae several hair like, terminally wavy, without visible ornamentation, the tip a fine point sometimes bent ; several in a follicle ; a mature seta 0.66 mm long, 3 µm wide at midlength. Spermathecae two pairs, in VIII and IX, each with elongate digitiform more or less tortuous ductless ampulla, and similar but much smaller and shorter iridescent diverticulum (H, P1).

Material examined : Stn 1 — holotype (Paris Museum AH 323), paratypes 1-4 (Paris Museum AH 324-327); paratypes 5 and 6 (BJ 1976.5.5-6).

Remarks

Diporochaeta macrochaeta was retained, with reservations, in *Plutellus* by Gates (1972). The necessity of broadening the definition of *Diporochaeta* to include lumbricine species with the perichaetine type-species (*vide* Jamieson, 1974*a*, 1976*a*) and restriction of *Plutellus* has here required inclusion, at least provisionally, of Oriental plutelli in *Diporochaeta* hut the generic status of *D. macrochaeta* is especially questionable. The new taxon is included as a subspecies in *D. macrochaeta*, the nominate subspecies of which is from the Anamalai Hills, but it is possible that its departures from Stephenson's description indicate specific distinction. Differences of *D. macrochaeta macrochaeta* include the following : male pores are in *ab* on minute papillae in the absence of a surrounding tumescent wall ; location of the gizzard mainly in VI (a questionable difference) ; origin of the intestine in XVIII ; flattening and terminal notching of the penial setae ; and the greater length of the spermathecal diverticulum relative to the ampulla.

Tribe MEGASCOLECINI Jamieson, 1971*a*

Genus **CELERIELLA** Gates, 1958. Emend.

Small to moderate sized earthworms with approximately 100 segments. Prostomium epilobous. First dorsal pore 4/5 or 5/6. Setae 12 to approximately 40 per segment, commencing on II ; with significant middorsal and midventral gaps : none between the male pores. Clitellum annular, anterior to the segment bearing the male pores, occluding intersegments and dorsal pores. Pores of the vasa deferentia and a single pair of tubular prostates 1 pair on XVIII. Female pores a minute pair, anteromedian of setae *a* of XIV. Spermathecal pores minute, 2 pairs in 7/8 and 8/9 or 1 pair in 7/8.

Some preclitellar septa thickened. Dorsal blood vessel single, continuous onto the pharynx ; last hearts in XII ; those in X-XII latero-oesophageal ; supra-oesophageal limited to the vicinity of these hearts ; subneural blood vessel absent. Gizzard large in VI. Oesophagus with high calciferous (?) lamellae in XIII and XIV but no extramural glands or with a pair of discrete extramural pouches in each of XIII and XIV of which the anterior pair sometimes communicates with the oesophageal lumen via the posterior pair. Intestine

commencing in XVI or XVII; muscular thickening, caeca and typhlosole absent. Meronephric; in the oesophageal region with exonephric and at least in one species enteronephric (pharyngeal) tufts followed by astomate, avesiculate, exonephric micromeronephridia. In the intestinal region, caudally or throughout its length, with several to many preseptal

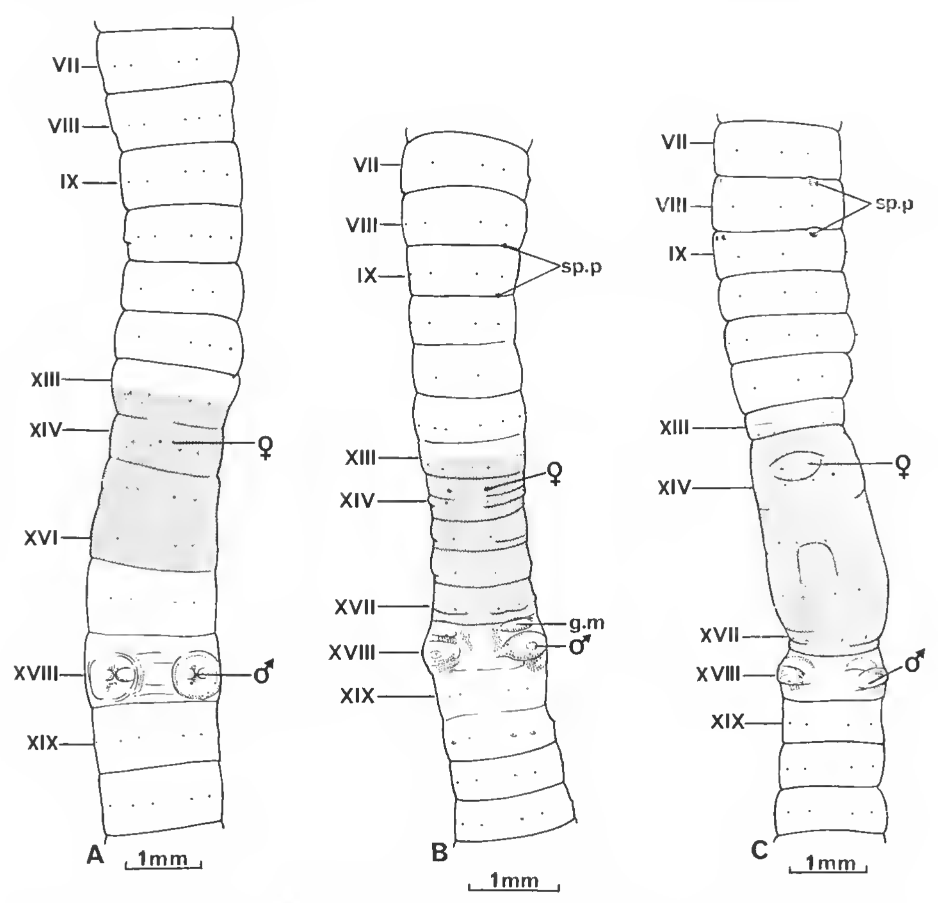


Fig. 2. — Genital fields. A, *Celeriella quadripapillata* (Stephenson, 1924) (specimen 1); B, *Diporochaeta dorsochaeta* sp. nov. (holotype); C, *D. dorsochaeta* (paratype 4).

nephrostomal funnels on each side in each segment corresponding with postseptal (always exonephric ?) avesiculate micromeronephridia; megameronephridia absent. Holandric, testis-sacs absent; seminal vesicles in XI and XII. Ovaries, with few to several eggstrings in XIII, ovisacs present, separate from the funnels in XIV. Prostates with 3 regions: an anterior (ectal) wide muscular duct which extends through 2 or more segments, a slender duct continuous with this and occupying a segment or less, and a very long, tortuous slenderly tubular gland extending through several to more than 10 segments. Combined vasa deferentia of a side joining the junction of gland and slender duct. Penial setae

absent. Spermathecae with ovoid ampulla, short duct and a single clavate to digitiform diverticulum.

TYPE SPECIES : *Spenceriella duodecimalis* Michaelsen, 1907.

DISTRIBUTION : Palni Hills, S. India.

REMARKS

GATES (1958) creeted *Celeriella* for Indian speeies whieh had been placed in the Austra-lian genus *Spenceriella*. The latter genus has been revived by JAMIESON (1972, 1974*b*) and its diseretenecss from *Celeriella* is confirmed. Important departures in the above new definition from that of GATES are the demonstration of several to many preseptal nephrostomal funnels (not merely one median funnel) in eaudal segments ; the inclusion of speeies with extramural ealeiferous glands, and demonstration of union of the vasa deferentia with the ental ends of the prostate duets. The multiple caudal nephrostomes confirm similarity which the Indian genus *Priodoscolex* (but not *Priodochaeta*) suggested by GATES ; they also occur in *Troyia* and in the Australia genera *Spenceriella* and *Oreoscolex*.

TABLE I. — Intersetal distances in segment XII as percentage of periphery.

	aa	ab	bc	cd	dd	dc	cb	ba	CIRCUMFERENCE (mm)
D. dorsochaeta									
Holotype	15.6	8.1	13.9	17.1	9.2	15.3	13.9	6.9	3.5
Range from	12.0	5.7	11.1	11.1	6.9	14.5	13.0	6.6	
to	15.9	9.3	17.5	20.5	13.2	18.1	15.9	10.2	
Mean of 8	14.4	7.7	13.2	16.7	9.4	16.2	14.3	8.1	
X intervals/ab	1.9	1.0	1.7	2.1	1.2	2.1	1.8	1.0	
D. macrochaeta simpliciseta									
Holotype	8.4	3.6	10.8	7.8	48.2	7.8	9.6	3.6	6.6
Range from	8.4	3.0	8.9	7.5	41.6	7.3	9.6	3.3	
to	11.2	3.9	12.0	13.2	48.2	8.9	11.2	3.9	
Mean of 5	9.7	3.5	10.5	9.1	45.2	8.1	10.3	3.6	
$\overline{X}$ intervals/ab	2.8	1.0	3.0	2.6	12.9	2.3	2.9	1.0	
Lampito bouchei									
Holotype	8.5	4.3	7.6	7.0	56.7	5.8	6.4	3.7	13.1
Paratype	10.0	4.3	7.7	6.2	53.5	7.3	7.1	3.9	11.2
Mean	9.3	4.3	7.7	6.6	55.1	6.6	6.8	3.8	
interval/ab	2.3	1.0	1.8	1.6	13.6	1.5	1.6	0.9	
T. gundarshola									
Holotype	7.5	3.8	9.7	5.9	50.7	8.0	10.7	3.8	14.9
interval/ab	2.0	1.0	2.6	1.6	13.3	2.1	2.8	1.0	

Key to species of *Celeriella*

1. Setae paired, 10-12 per segment, in at least the forebody........................ 2
— Setae not paired, 40-50 per segment.. 6
2. 2 pairs of spermathecae.. 3
— 1 pair of spermathecae.. 4
3. Spermathecal pores in the vicinity of *a* lines. Spermathecal diverticulum approximately half the length of the ampulla. Longitudinal tubercula pubertatis each with a longitudinal row of minute orifices in ½ XVII-½ XIX........................ *C. punctata* sp. nov.
— Spermathecal pores in *bc* lines. Spermatheeal diverticulum more than twice the length of ampulla and duct. No tubercula pubertatis............ *C. ditheca* (Stephenson, 1924)
4. Spermathecal pores in or just lateral to *b* lines.................................. 5
— Spermathecal pores in or close to *d* lines........ *C. quadripapillata* (Stephenson, 1924)
5. Setae in 12 regular longitudinal rows throughout the body.............................. *C. regularis* (Stephenson, 1924)
— Only *a* and *b* setae in regular rows throughout; in the hindbody other rows irregular and number increased to 14-17 per segment............ *C. duodecimalis* (Michaelsen, 1907)
6. Male papillae medianly contiguous; male pores lying in a transverse midventral groove but not at the anterior ends of longitudinal grooves; ectal muscular duct of prostate considerably shorter than gland.................................... *C. kempi* (Stephenson, 1924)
— Male papillae not medianly contiguous; male pores not in a transverse midventral groove but each at the anterior end of a comma-shaped seminal groove; ectal muscular duct of prostate at least twice as wide as the gland............................ *C. bursata* sp. nov.

Celeriella bursata sp. nov.

(Fig. 2 A; 4 A; 6 A; Table 2)

Length 82 mm, width (midelitellum) 2.6 mm, segments 110. Prostomium epilobous ½, open, narrow and parallel-sided. First dorsal pore 5/6. Setae 40 in XII, 42 in XX; in XII *aa* : *ab* : *zy* : *zz* = 3.0 : 1.0 : 1.0 : 1.5 : 5.2; no setae between the male pores. Nephropores not externally visible. Clitellum not developed. Male pores in setal lines 4 on a pair of eonspieuous hemispheroidal papillae in XVIII, eaeh pore at the anterior end of a broad seminal groove whieh runs posteromedianly to the posterior edge of the porophore and then eonstinues on a tumid extension to the posterior margin of XVIII, the porophore plus extension having the form of a eomma. Female pores minute, shortly anteromedian of setae *a* of XIV. Spermatheeal pores minute, eoneealed in intersegmental furrows 7/8 and 8/9, in *ab*; those in 8/9 0.44 mm apart.

Thiekest septa 10/11 and 11/12, very strong. Dorsal blood vessel single; continuous onto the pharynx; last hearts in XII; only those in X-XII latero-oesophageal, eaeh with conneetive from dorsal and supra-oesophageal vessel; supra-oesophageal well developed, in X-XIV; subneural vessel absent. Gizzard in VI, very large and strongly museular and fusiform, extending into X by displaeement of septa. Oesophagus with true extramural ealciferous glands, a pair in eaeh of XIII and XIV; eaeh gland a large lateral poueh broadly attached to the oesophagus, without narrow eonneetion, but its lumen divided

by numerous radial longitudinal lamellae which run from the outer wall and join the external wall of the oesophagus, the mode of opening into the oesophagus not determined. Intestine commencing in XVII: muscular thickening, caeca and typhlosole absent. Nephridia paired tufts in III, IV and V enlarging posteriorly to large in V, with multiple discrete ducts discharging (all ?) exonephrically; a few small nephridia forming a transverse row anteriorly in III; the equivalents of the tufts in VI and VII becomming diffuse laterally and a parietal transverse band of exonephric astomate micromeronephridia developed by VIII. By XIII these nephridia are much smaller and are scattered on the parietes. In the anterior intestinal region in the order of 10 more elongate but otherwise similar nephridia on each side in each segment. Caudally with approximately 15 long stalked preseptal nephrostomal funnels on each side on the posterior septum of each segment, the nephridial bodies densely clothing the posterior face of the septum; some if not all of these nephridia exonephric; no megameronephridia. Holandric, funnels iridescent in X and XI; testis-sacs absent; much subdivided racemose seminal vesicles in XI and XII. Ovaries small, with several strings of large oocytes, and funnels in XIII; ovisacs absent. Prostates tubular, immensely long, the glandular portion very tortuous and extending from XXII to XXXIII, passing anteriorly into a narrow winding tube with spermatozoal (?) iridescence (intermediate tube) which runs through XXI to posterior XX (receiving the vas deferens posteriorly), becomes strongly muscular and wider at its anterior end and passes into an unusually wide very muscular duct (bursa) extending from it to the male pore equatorialy in XVIII, narrowing shortly before the pore. Vas deferens traced from XVII to the ectal end of the widest part of the terminal bursa but emerging again to run down the intermediate tube and apparently joining the ental end of the latter. Spermathecae 2 pairs in VIII and IX, each with a large ovoid ampulla and slightly longer digitiform diverticulum, more than half as wide; free extremity of diverticulum slightly swollen and with spermatozoal iridescence.

Material examined : Stn 1 — holotype (Paris Museum AH 328).

Remarks

Celeriella bursata is morphologically close to *C. kempi* (Stephenson, 1924) the only other species of the genus with more than 12 setae in anterior segments. The latter species is known only from a single apparently immature and imperfectly characterized specimen. Distinction of *C. bursata* from it is therefore not as positive as would be desirable. Differences from *C. kempi* as described by Stephenson are as follows. The male papillae are not medianly contiguous; the male pores do not lie in a transverse midventral groove; a longitudinal seminal groove is present, extending onto a posterior prolongation of each male porophore; although the terminal prostate duct in *C. kempi* is " shiny, and considerably stouter " than the remainder, the enormous muscular thickening of the ectal duct in *C. bursata* is clearly of a different order, rarely attained in megascoleeines, meriting application of the term bursa. Only one pair of structures questionably recognizable as spermathecae has been seen (in IX) in *C. kempi* but it would be premature to state that the two taxa differ with respect to their spermathecae. The possibility nevertheless remains

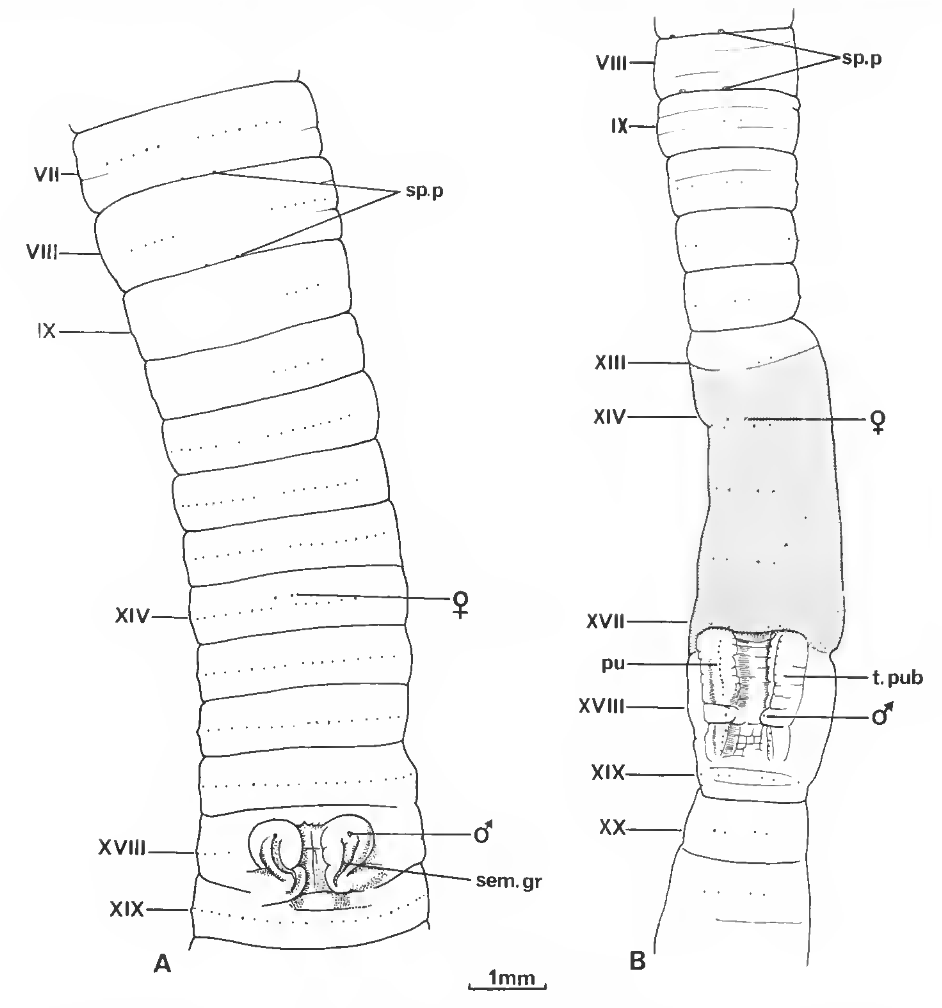


Fig. 3. — Genital fields.
A, *Celeriella bursata* sp. nov. (holotype) ; B, *Celeriella punctata* sp. nov. (holotype).

that discovery and examination of further material of *C. kempi* from the type-locality, Marian Shola in the Palni Hills, may narrow these distinctions and may necessitate regarding *C. bursata* as its junior synonym.

Celeriella punctata sp. nov.
(Fig. 3 B ; 4 B ; 6 B ; Table II)

Length 80, 75, 84 mm, width (midclitellum) 2.1, 2.0, 1.8 mm, segments 137, 127, 139 (holotype and paratypes 1 and 2 ; paratype 3 is a posterior amputee). Prostomium epilobous 1/4, broad closed. First dorsal pore 5/6. Setae 12 per segment throughout, in 3

regular pairs on each side, the ventral pair (*ab*) closely paired, the next pair (*cd*) moderately closely, the third pair (*zy*) widely paired ; *zz* and *aa* wide interruptions throughout, *zz* especially wide anteriorly but little wider than *zy* caudally ; in XII *aa* : *ab* : *bc* : *zy* : *zz* averaging 2.4 : 1.0 : 1.5 : 1.8 : 6.0 (H, P1-3). Nephropores not externally recognizable. Clitellum annular, ½ XIII-XVII, intersegments, dorsal pores and setae occluded. Male pores a pair of minute orifices equatorialy in XVIII in *a* lines, each pore on an indistinct papilla which is part of a longitudinal tumescence (tuberculum pubertatis) which extends from the equator of XVII almost to the equator of XIX ; each tuberculum bearing a longitudinal row of closely set dark points in single file in *ab* extending throughout its length, excepting the small male papilla ; 11 points between the setal arc of XVII and the male papilla, and 4 points behind it, on the right tuberculum (H, P1-2) ; no longitudinal rows of points visible in P3. These points shown in longitudinal sections (P4) to be each the orifice of a hemispheroidal thickly muscular organ. Female pores minute, anteromedian to setae *a* of XIV. Spermathecal pores 2 pairs, in 7/8 and 8/9, on minute papillae immediately lateral of *a* lines.

Thickest septa 6/7-8/9, moderately strongly thickened. Dorsal blood vessel single, continuous onto the pharynx ; last hearts in XII ; only those in X-XII latero-oesophageal, each receiving a connective from the supra-oesophageal vessel and an exceedingly slender one from the dorsal vessel ; supra-oesophageal in X-XII, well developed ; subneural vessel absent. Gizzard in VI, large and strongly muscular, cylindrical, extending to ½ IX by backward deflection of septa. Oesophagus with 2 pairs of large, very discrete, ovoid calciferous glands, in XIII and XIV, the larger anterior pair, though appearing discrete, passes at the posterior end into the glands of XIV of which they are merely an expansion anterior to septum 13/14 ; the glands of XIV attached by their ventral poles to the oesophagus posteriorly in the segment ; the lumen with numerous high vascular laminae which almost occlude the lumen of the gland but do not fuse across it. Intestine commencing with abrupt expansion in XVI ; muscular thickening, caeca and typhlosole absent. Nephridia : two pairs of very large tufts in V and VI (the latter at the anterior limit of the gizzard) send composite ducts forward to join the wall of the pharynx ; there is also a pair of small tufts posteriorly in each of VI and VII, discharging exonephrically in their respective segments and it is likely, therefore, that the large anterior tufts in VI belong to V, or even further anteriorly, septum 5/6 being unrecognizable ; diffuse exonephric tufts, scarcely sufficiently compact to be considered tufts, in VIII and IX ; rudimentary tufts and a few parietal meronephridia in X and XI ; sparse astomate exonephric, avesiculate parietal meronephridia in XII posteriorly. Caudally with several minute preseptal nephrostomal funnels on each side in each segment ; some at least of the nephridia exonephric, a transverse wad of nephridial tubules near the anterior septum and adherent to the dorsolateral aspect of the intestine is apparently also exonephric by several ducts though enteronephry cannot be considered disproved. Holandric : iridescent sperm funnels in X and XI ; testis-sacs absent ; much-divided racemose seminal vesicles in XI and XII. Ovaries, with few conjoined strings of large oocytes, and funnels in XIII ; large ovisacs in XIV dorsal to the oesophagus, not connected with the oviductal funnels. Prostates slenderly tubular, very long, the glandular portion tortuous, though linear, extending through XIX to XXVII, passing anteriorly at ½ XX, into a narrow sinuous duct which continues into XIX, transforming in this into a wide muscular duct, also sinuous, which discharges equatorialy in

XVIII in *a* lines ; vas deferens joining the junction of gland and duct. The longitudinal series of hemispheroidal glossy swellings of the tubercula pubatatis and the male pores overlain by laterally radiating muscle bands. Spermathecae 2 pairs, in VIII and IX, the posterior pair significantly the larger ; each with ovoid sometimes apically lobed ampulla and slender tortuous duct which is joined at midlength by a median clavate inseminated diverticulum which is almost half the length of the ampulla.

Material examined : Stn 5 — holotype (Paris Museum AH 329), paratypes 1-2 (Paris Museum AH 330-331) ; paratype 3 and (sections) 4 (BJ 1976.5.7-8).

Remarks

The only other quadrithecal species of *Celeriella*, at least with 12 setae per segment, is the inappropriately named *C. ditheca* (Stephenson, 1924). This is again, very inadequately described from a single specimen but the new material here named *C. punctata*, differs from Stephenson's description of *C. ditheca* in the following respects. Spermathecal pores are in the vicinity of *a* lines (not in *bc*) ; the spermathecal diverticulum is only about half the length of the ampulla (not approximately twice the length of ampulla + duct) ; prostates end in XXVII (not XXXIII or XXXIV) ; calciferous glands are better developed in XIV than in XIII and dorsal pores commence in 5/6 (not 4/5). The remarkable tubercula pubertatis with their longitudinal rows of minute dark orifices have not been reported for *C. ditheca.*

Celeriella quadripapillata Stephenson, 1924
(Fig. 2 A ; 5 C ; 6 C ; Table II)

Length 68, 62, 84 mm, width (midclitellum) 1.6, 1.4, 1.6 mm, 91, 98, 105 segments (specimens 1-3). Prostomium epilobous ½, small, open, parallel sided. First dorsal pore 4/5 (1,2). Setae in 12 longitudinal rows throughout, though 1 of each ventralmost pair is absent in XII in specimens 1 and 5 ; in XII *aa* : *ab* : *bc* : *zy* : *zz* averaging 2.2 : 1.0 : 1.3 : 1.2 : 2.0 (5 specimens) ; *aa* conspicuously wider, *zz* hardly appreciably wider than adjacent intervals throughout. Nephropores not externally recognizable. Clitellum ½ XIII-XVI, weakly developed, intersegmental furrows slightly obscured. Male genital field a large low but distinct circular tumescence fringed by concentric rings centred on *ab* and filling the posterior three-fourths of segment XVIII ; each tumescence bearing a pair of small papillae side by side and almost pinched together, the lateral one in *b* line, the median one in *ab* relative to adjacent segments ; the male pore situated between the papillae and almost concealed by them. The body ventrally flattened in the vicinity of the tumescences and depressed between them so that the tumescences occupy longitudinal ridges. Female pores shortly anteromedian of setae *a* in XIV. Spermathecal pores 1 pair, in 7/8, in *d* lines, minute with slight peripheral tumescence.

Thickest septa 6/7 and 7/8, moderately strongly thickened. Dorsal blood vessel single, continuous onto the pharynx ; last hearts in XII, only those in X-XII latero-oesophageal, each with a connective from the dorsal and supra-oesophageal vessel ; supra-oesophageal well developed, in at least ½ VIII-XII ; subneural vessel absent. Gizzard in VI, mode-

rately large, strongly muscular, globose, extending to ½ VIII by backward deflection of septa. Oesophagus dilated in each of XIII and XIV and with numerous free high internal radial lamellae extending into its lumen but with no separate extramural calciferous glands. Intestine commencing in XVI but not considerably widening until XVII; muscular thickening and caeca absent; a very rudimentary dorsal ridge present from XXIII does not warrant recognition of a typhlosole. Nephridia : a very large pair of tufts in each of VI and VII sending a composite duct into V and VI, respectively, on each side which appears to be exonephric. Astomate exonephric micromeronephridia in VIII-X several scattered on the parietes; by XI forming a sparse transverse band, the band becomming more dense with some median ventral aggregation by XIV in which some nephridia appear to have intrasegmental nephrostomes; caudally with several preseptal nephrostomes on each side but no discernible enteronephry. Holandric; iridescent funnels in X and XI; testis-sacs absent; much-divided racemose seminal vesicles in XI and XII. Ovaries small with several fused strings of large oocytes, and funnels in XIII; ovisacs absent. Prostates slenderly tubular, immensely long, the glandular portion tortuous and extending through XXII-XXVI, passing anteriorly into a narrow winding tube which runs through XXI (receiving the vas deferens posteriorly) and in XX to the pore in XVIII forms a very wide, glossy muscular terminal bursa. Spermathecae 1 pair, in VIII, each with ovoid-reniform ampulla and narrowly tapering indistinctly demarcated duct which enters the body wall in common with a long, twisted, inseminated, digitiform diverticulum which is longer than ampulla plus duct.

Material examined : Stn 2 — 1 (BJ 1976.5.9). Stn 3 — 4 (Paris Museum AH 332-AH 335); 1 (BJ 1976.5.10).

Type-Locality : Kodaikanal, Palni Hills.

Genus **TROYIA** nov.

Setae 8 per segment, commencing on II, widely paired. Clitellum annular, anterior to the segment bearing the male pores. Pores of the vasa deferentia and a single pair of tubuloracemose prostates 1 pair on XVIII. Female pores a minute pair, anteromedian of setae *a* of XIV. Spermathecal pores a pair at the anterior margin of VIII.

Some preclitellar septa thickened. Dorsal blood vessel single, continuous onto the pharynx; last hearts in XII; those of X-XII latero-oesophageal; supra-oesophageal limited to the vicinity of these hearts; subneural vessel absent. Gizzard large, in VI or VII (?). 3 pairs of discrete extramural calciferous glands in XIII, XIV and XV, ventrally attached to the oesophagus by narrow connectives but virtually sessile, their walls with numerous free radial laminae. Intestine commencing in XVI; muscular thickening, caeca and typhlosole absent. Meronephric; enteronephric tufts in V; exonephric (?) tufts in VI-XIII; caudally with numerous preseptal nephrostomal funnels on each side in each segment corresponding with postseptal exonephric avesiculate micromeronephridia; megameronephridia absent. Holandric; testis-sacs absent; seminal vesicles in XI and XII. Ovaries with many egg strings in XIII; ovisacs present, separate from the funnels, in XIV.

TABLE II. — Intersetal distances in segment XII as percentage of periphery.

	aa	ab	bc	zy	zz	CIRCUMFERENCE (mm)
C. bursata						
Holotype	4.0	1.3	1.4	2.0	6.7	9.1
interval/ab	3.0	1.0	1.0	1.5	5.3	
C. punctata						
Holotype	11.3	5.0	5.4	10.1	31.5	3.7
Range from	7.9	3.7	5.4	5.5	23.2	
to	12.5	5.0	9.0	10.1	31.5	
Mean of 4	10.1	4.3	6.6	7.8	25.9	
interval/ab	2.4	1.0	1.5	1.8	6.0	
C. quadripapillata						
Holotype	13.4	6.7	7.8	6.7	14.2	5.4
Range from	12.1	5.6	7.5	6.1	9.5	
to	15.6	7.1	9.8	11.7	17.1	
Mean of 5	13.9	6.4	8.3	7.6	12.9	
interval/ab	2.2	1.0	1.3	1.2	2.0	
L. sylvicola						
Range from	9.2	3.9	4.3	4.8	28.3	
to	12.4	5.2	7.2	6.7	38.8	
Mean of 5	10.6	4.3	5.9	5.5	33.6	
interval/ab	2.5	1.0	1.4	1.3	7.9	

Prostates with 3 regions, an anterior (ectal) wide muscular duct which extends through more than 1 segment, a short slender duct continuous with this and a linear tubuloracemose gland extending through several segments. Combined vasa deferentia of a side joining the junction of gland and slender duct. Penial setae absent. Spermathecae with single, clavate diverticulum.

TYPE SPECIES : *Troyia gundarshola* sp. nov. (Monotypic).
DISTRIBUTION : Palni Hills, S. India.

REMARKS

Troyia is very closely related to *Celeriella* of which it is here regarded as the apomorph sister-group, its apomorph characters relative to *Celeriella* being the third pair of calciferous glands, in XV, and the tubuloracemose rather than tubular form of the prostates. If presence of calciferous glands in XIII-XV were treated as a specific rather than a generic character, *T. gundarshola* would probably have to be placed in *Celeriella*.

Troyia gundarshola sp. nov.
(Fig. 1 B ; 5 D ; 6 D ; Table I)

Length 273 mm, width (midclitellum) 7.0 mm, 297 segments. Prostomium proepilobous but impinging on about 1/3 of the peristomium (H) or epilobous 2/3 (P1). First dorsal pore 5/6. Setae in 8 longitudinal rows, *a* developing slight sporadic irregularity posteriorly but *d* and then *c* and *b* becoming very irregular ; in XII (H) *aa* : *ab* : *bc* : *cd* : *dd* = 2.0 : 1.0 : 2.7 : 1.9 : 13.3 ; *dd* : *u* = 0.51. Nephropores not externally visible. Clitellum annular, strongly tumid, 1/3 XIII-XVII, intersegmental furrows partially obscured ventrally. Male pores in *ab*, near *a*, of XVIII, relative to adjacent segments, each with wide tumid lips which constitute a papilla ; a short inconspicuous groove extending from each pore onto the anterior lip may be a seminal groove ; the two papillae medianly contiguous. Female pores minute, anteromedian to setae *a* of XIV. Spermathecal pores a pair of indistinct slits near the anterior margin of VIII slightly median of *a* lines, in a common tumid area, with the appearance of closed lips, the anterior and posterior lip filling the corresponding halves of segments VII and VIII.

Thickest septa 8/9-12/13, strongly thickened, with 9/10-11/12 the strongest ; all of these funnel shaped. Dorsal blood vessel single, continuous onto the pharynx ; last hearts in XII ; only those in X-XII latero-oesophageal, each with a connective from dorsal and supra-oesophageal vessel (H, P). Supra-oesophageal in posterior IX to anterior XIII, well developed. Subneural vessel absent. Gizzard in VII, i.e. abutting on septum 7/8 posteriorly without intervention of other septa (H, possibly anterior to the extremely attenuated septum 6/7 in P) ; large, strongly muscular, broadly cylindrical with anterior rim ; extending into X by backward displacement of septa. Oesophagus with 3 pairs of large very discrete calciferous glands, a pair in each of XIII, XIV and XV (H, P) ; each gland ovoid, with the longest axis approximately vertical, and with a very narrow attachment at its ventromedian extreme to the oesophagus without intervention of an appreciable stalk ; a transverse section of the gland reveals numerous closely packed radial septa or laminae which almost occlude the lumen but do not join across it ; the laminae mostly free axially but some fused with adjacent laminae. Intestine commencing in XVI ; muscular thickening, caeca and typhlosole absent (H, P1). Nephridia : very small paired exonephric tufts in (II ?), III and IV ; large paired astomate, enteronephric tufts in V sending long composite ducts forwards to the anterior limit of the pharynx ; paired tufts in VI-XIII becoming smaller and more diffuse, (all ?) exonephric. Integumentary nephridia in XIV XVII very numerous minute astomate micromeronephridia covering the entire parietes. In XVIII posteriorly each segment with moderately numerous but sparsely distributed astomate exonephric micromeronephridia on each side. Caudally with a parietal band of (exonephric ?) meronephridia and numerous minute (enteronephric ?) micromeronephridia on the posterior face of each septum corresponding with small, long-stalked preseptal funnels ; no megameronephridia present. Holandric ; sperm funnels iridescent in X and XI ; testis-sacs absent ; racemose much divided seminal vesicles in XI and XII (H, P). Ovaries with many strings of large oocytes, and funnels, in XIII ; large structures with many moniliform projections in XIV appear to be ovisacs (H, P). Prostates tubulora-

cemose, a pair in XVIII-XXV, the glandular portion, in XX-XXV, depressed and alternately incised so that it is still referable to a tortuous depressed tubular form ; muscular ectal duct narrow and coiled for a short portion near the gland but of moderate and uniform width for most of its length ; receiving the vas deferens at junction with the gland (H) ; in the paratype the prostate duct extends through XVIII-XX ; the glandular portion is thickly strap-like, in posterior XX-XXV. Penial setae absent. Spermathecae in VIII, basically a pair but that on the left with ampulla and diverticulum completely duplicated, the two spermathecae smaller than the single right spermatheca which has large ovoid slenderly tapering but virtually ductless ampulla and a single median clavate longer diverticulum which joins it basally.

Material examined : Stn 5 — holotype (Paris Museum AH 336). Stn 4 — paratype (BJ 1976.5.12).

Remarks

Location of extramural calciferous glands in XIII-XV distinguishes *T. gundarshola* from all other Indian megascolecids.

Genus **LAMPITO** Kinberg, 1866

Dorsal pores present. Setae 8 to numerous per segment. Clitellum annular. Pores of the vasa deferentia and a single pair of racemose or tuburoracemose (strap-shaped) prostates 1 pair on XVIII. Female pores paired on XIV. Spermathecae 2 or 3 pairs, pores intrasegmental, or at the anterior intersegmental furrows of VII, VIII and IX.

Vascular system with unpaired dorsal, ventral and supra-oesophageal trunks but no subneural, paired extra-oesophageals median to the hearts, paired lateroparietal trunks from the anal region connecting in XIII with extra-oesophageal and supra-oesophageal trunks ; last hearts in XIII ; those in X-XIII (sometimes only XII and XIII) latero-oesophageal. Gizzard in V. Calciferous tissue in longitudinally placed, more or less lamelliform ridges on the inner wall of the oesophagus in X-XIII. Intestine commencing in XV-XVI, typhlosole present or (*L. bouchei*) absent ; muscular thickening and caeca absent. Meronephric ; all nephridia avesiculate, paired clusters (tufts) of astomate micromeronephric tubules on anterior faces of septa in V-(XI ?) XIII, XIV, ducts from some clusters opening into the pharynx ; numerous astomate v-shaped micromeronephridia per segment on the parietes from (XIII or XIV ?) XV posteriorly, in transverse bands ; the median nephridium on each side enlarged as an enteronephric megameronephridium with preseptal funnel from XX or XXI posteriorly ducts passing to the roof of the intestine and (always ?) joining a median longitudinal supra-intestinal canal from which a pair of ductules opens into the gut in each segment. Holandric or metandric ; gymnorchous ; seminal vesicles in XI and XII, or XII only. Prostates tubuloracemose or racemose ; vasa deferentia joining the ental ends of the prostate ducts. Penial setae present or absent.

Ovaries, with multiple strings of oocytes, in XIII ; ovisacs (always ?) present. Spermathecae each with a lateral and a median small diverticulum.

Type species : *Lampito mauritii* Kinberg, 1866.

Distribution : Palni and Cardomom Hills of South India. The type-species with a wide global distribution (by transportation ?).

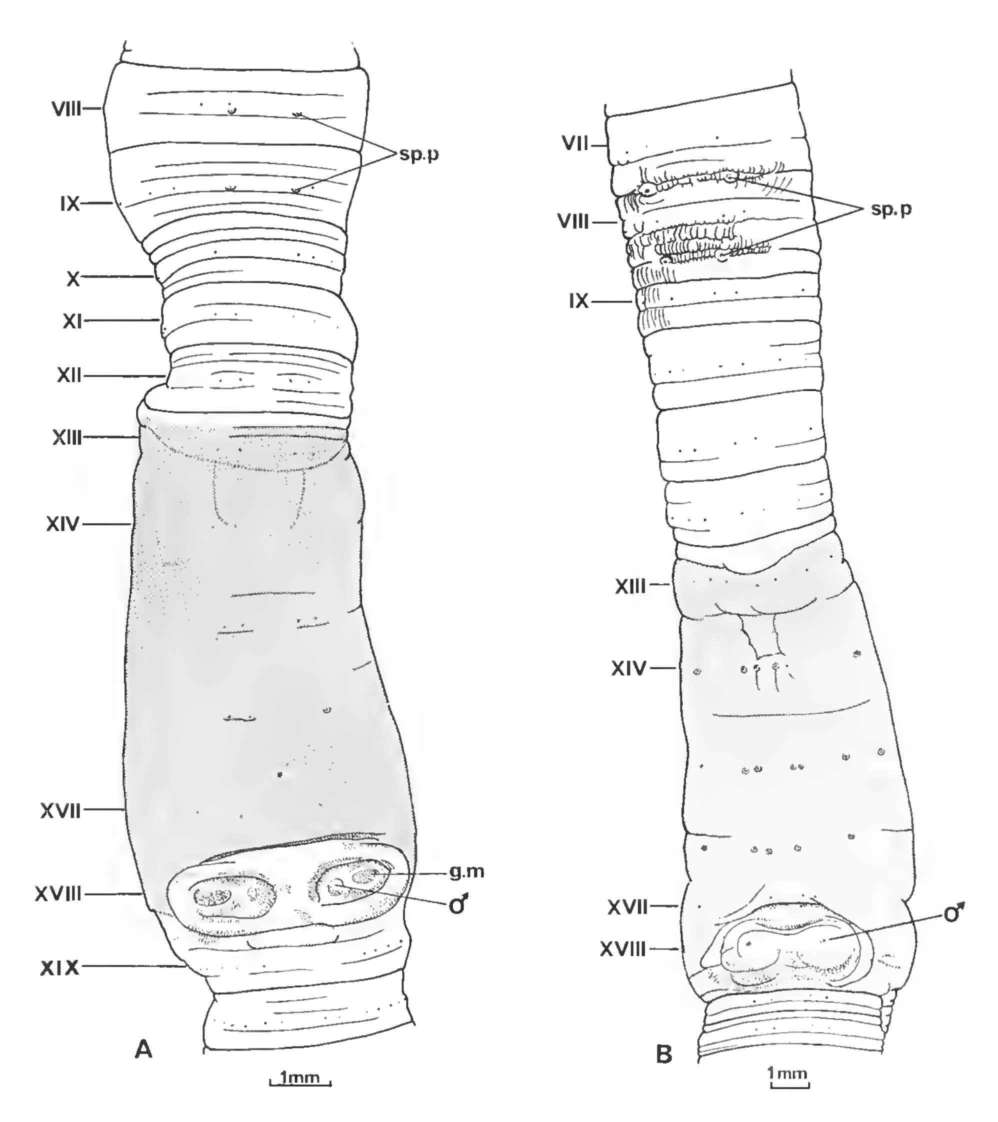


Fig. 4. — Genital fields.
A, *Lampito sylvicola* Michaelsen, 1907 (specimen 1) ; B, *Lampito bouchei* sp. nov. (holotype).

KEY TO SPECIES OF *Lampito*

1. Sperm funnels in X and XI 2
— Sperm funnels in XI only 3
2. Spermathecal pores 2 pairs ; setae 8 per segment 7
— Spermathecal pores 3 pairs ; setae more than 8 per segment. *L. mauritii* Kinberg, 1866
3. Male pores in a single field, typhlosole bifid ventrally. *L. marianae* (Stephenson, 1924)
— Male pores not in a single field, typhlosole not bifid ventrally 4
4. Spermathecal pores with same intrasegmental location in VIII as in IX 5
— Spermathecal pores postsetal in VIII, presetal in IX .... *L. kempi* Gates, 1938
5. Spermathecal pores presetal .... *L. vilpattiensis* (Michaelsen, 1907)
— Spermathecal pores not presetal 6
6. Spermathecal pores equatorial .... *L. kumiliensis* (Aiyer, 1929)
— Spermathecal pores postequatorial .... *L. sylvicola* (Michaelsen, 1907)
7. Seminal vesicles in XI and XII. A very low typhlosole present .... *L. palniensis* (Stephenson, 1924)
— Seminal vesicles in XII only. Typhlosole absent .... *L. bouchei* sp. nov.

Lampito bouchei sp. nov.
(Fig. 4 B ; 5 G ; 6 J ; Table I)

Length 80 +, 195 mm (H, posterior amputee ; P), width (midclitellum) 5.2, 3.8 mm, 304 segments (P). Prostomium procpilobous ?, in both specimens withdrawn and not visible. First dorsal pore (minute) 10/11. Setae in 8 regular longitudinal rows throughout ; in XII *aa* : *ab* : *bc* : *cd* : *dd* averaging 2.3 : 1.0 : 1.7 : 1.6 : 13.6 ; *dd* : *u* = 0.54 — 0.57 (2 specimens). Nephropores not externally visible. Clitellum orange-brown, very strongly tumid ; 1/3 XIII-1/3 XIX, intersegmental furrows obscured (H.) Male pores very slightly lateral of *b* lines of XVIII, relative to adjacent segments, on conspicuous medianly conjoined hemispheroidal papillae which overhang the anterior and posterior limits of the segment and are jointly circumscribed by an indistinct tumid band which intrudes on XVII and XIX (H, P). Female pores minute, anteromedian to setae *a* of XIV (P). Spermathecal pores small but conspicuous papillae in 7/8 and 8/9, in *a* lines, the adjacent segments puckered in their vicinity (H, P).

Thickest septa 5/6-12/13, strongly thickened, with 7/8-10/11 the strongest ; all of these funnel shaped. Dorsal blood vessel single, continuous onto the pharynx ; last hearts in XIII ; those in X-XIII latero-oesophageal, each with a connective from dorsal and supra-oesophageal vessel (H, P). Supra-oesophageal ½ IX-XIII, well developed ; subneural vessel absent. Gizzard in V, large, strongly muscular, globose but with anterior rim, extending to IX by displacement of septa. Oesophagus in VIII-XIII with numerous delicate high radial laminae, especially in XII-XIII, but these projecting into the general oesophageal lumen and extramural calciferous glands absent. Intestine commencing in XVI (P) ; muscular thickening, caeca and typhlosole absent. Nephridia : a pair of

large tufts in V at the anterior limit of the gizzard sending a thick duct on each side to the pharynx; a pair of large tufts in each of VI-IX send a composite duct forward on each side traced to the junction of the anterior septum of each segment with the ventral parietes. Smallers tufts in X and XI. By the posterior oesophageal region (XV) there are transverse parietal bands of hushy apparently astomate and exonephric meronephridia. From XXI there are several small parietal astomate exonephric micromeronephridia on each side in transverse single file but the median-most nephridium is enlarged as a megameronephridium, with preseptal funnel, the body of the nephridium extending around the gut almost to the dorsum, the long, narrow duct of each running on the anterior septum and entering the intestine near the dorsal vessel; this condition persisting to the caudal extremity but the megameronephridium there becoming very slender, though still extensive laterally; presence or absence of a longitudinal excretory duct not determinable. Holandric with incipient metandry: large testes and iridescent funnels in XI with large racemose seminal vesicles in XII; in X with non-iridescent sperm funnels and no evident testes; testis-sacs absent. Ovaries, with many strings of large oocytes, and funnels in XIII; large seminal vesicle-like structures on the anterior septum of XIV may be ovisacs. Prostates, 1 pair in XVIII and XIX, elongate racemose with secondary lobes which indicate internal branching of ducts; ectal muscular duct forming a loop of moderate length and receiving the vas deferens at its junction with the gland. Penial setae absent. Spermathecae 2 pairs, in VIII and IX, each with elongate clavate ampulla filling the segment longitudinally and with 2 basal inseminated diverticula which may be simple, bifid, or trifid.

Material examined: Stn 1 — holotype (Paris Museum AH 337); paratype (BJ 1976.5.13).

Remarks

Lampito bouchei is morphologically close to *L. palniensis* (Stephenson, 1924), the only other species of *Lampito* with only 8 setae per segment throughout the body. It is here separated with some hesitation from *L. palniensis* because it possesses the following distinctions: well developed male porophores and an apparently different male genital field; restriction of the seminal vesicles to XII; total absence of a typhlosole; and presence of latero-oesophageal hearts in X-XIII (not merely XII and XIII ?).

Lampito sylvicola Michaelsen, 1907
(Fig. 4 A; 5 F; 6 I; Table II)

Length 198 mm, width (midclitellum) 4.2 mm, 239 segments (specimen 1; other specimens are posterior amputees). Epilobous, c. ½ ? (1 specimen, withdrawn in other 4 specimens). First dorsal pore 10/11. Setae 16 in XII, 30 in XX, 42 in a caudal segment; *aa* and *zz* conspicuous gaps excepting caudally where *aa* is no larger than other intersetal distances; in XII *aa* : *ab* : *bc* : *zy* : *zz* averaging 2.5 : 1.0 : 1.4 : 1.3 : 7.9 (specimens 1-5). Nephropores not externally recognizable. Clitellum strongly tumid, 1/4 XIII-2/3 XVIII ($= 5\frac{5}{17}$ segments); intersegmental furrows and dorsal pores occluded; setae retained.

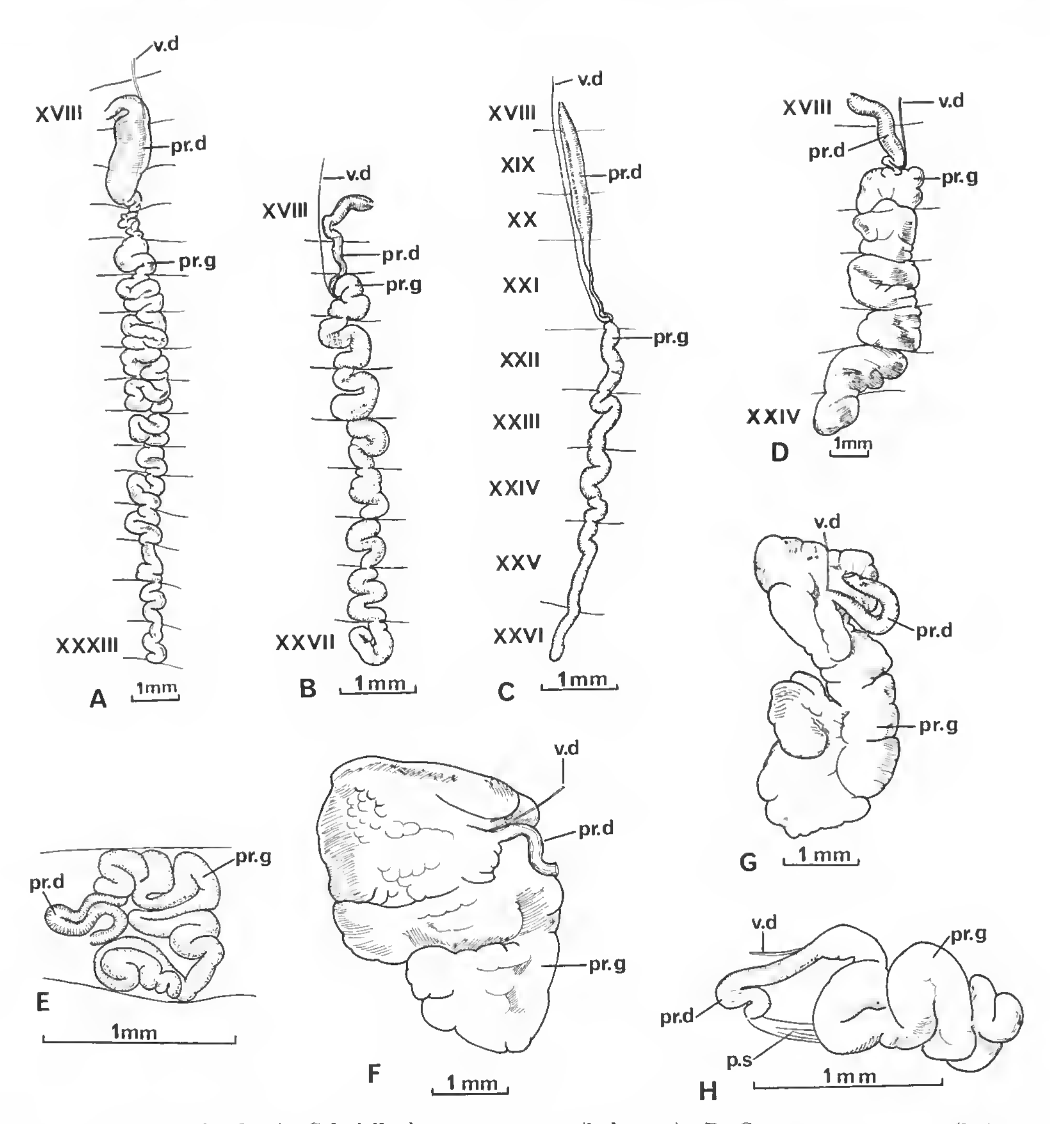


Fig. 5. — Prostate glands. A, *Celeriella bursata* sp. nov. (holotype) ; B, *C. punctata* sp. nov. (holotype) ; C, *C. quadripapillata* (Stephenson, 1924) (specimen 1) ; D, *Troyia gundarshola* sp. nov. (holotype) ; E, *D. dorsochaeta* sp. nov. (paratype 1) ; F, *Lampito sylvicola* Michaelsen, 1907 (specimen 1) ; G, *Lampito bouchei* sp. nov. (holotype) ; H, *Diporochaeta macrochaeta simpliciseta* subsp. nov. (holotype).

Male pores in *ab* of XVIII (relative to adjacent setigerous segment) on minute papillae, each papilla flanked by an ovoid tumescent genital marking ; the papilla and marking lying in a deep oval depression in a common oval strongly tumid pad which fills XVIII longitudinally and extends between the two depressions. The lateral genital marking not apparent in some specimens. Female pores probably paired, represented by a trans-

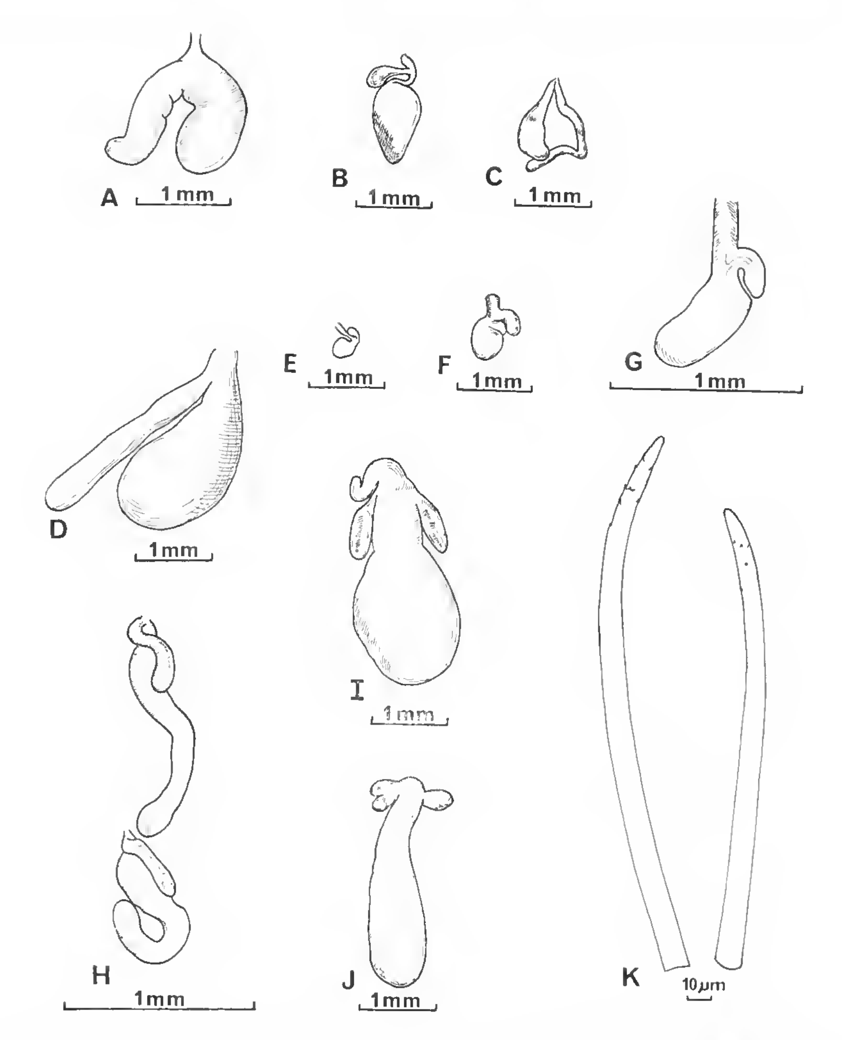


FIG. 6. — A-J, Spermatheeae. A, *Celeriella bursata* sp. nov. (holotype) ; B, *C. punctata* (holotype) ; C, *C. quadripapillata* (Stephenson, 1924) (specimen 1) ; D, *Troyia gundarshola* sp. nov. (holotype) ; E-G, *Diporochaeta dorsochaeta* sp. nov. : E, holotype ; F, paratype 2 ; G, paratype 1 ; H, *Diporochaeta macrochaeta simpliciseta* subsp. nov., right spermatheeae of VIII and IX *in situ* ; I, *Lampito sylvicola* Michaelsen, 1907 (specimen 1) ; J, *Lampito bouchei* sp. nov. (holotype) ; K, *Diporochaeta dorsochaeta* sp. nov., left penial setae (holotype).

verse slit presetally in XIV. Spermathecal pores 2 pairs of minute papillae at the posterior border of the setal annulus in *a* lines in VIII and IX.

Thickest septa 6/7-9/10, strongly thiekened and funnelshaped. Dorsal blood vessel single, eontinuous onto the pharynx ; last hearts in XIII ; only those in X-XIII latero-oesophageal, each with a eonneetive from the dorsal and supra-oesophageal vessel. Supra-oesophageal in X-XIII, well developed only in XIII ; subneural vessel absent. Gizzard in V, large, strongly museular, fusiform extending to X by baekward displaeement of septa.

Oesophagus lacking extramural calciferous glands. Intestine commencing in XVI ; muscular thickening and caeca absent ; a low but distinct, broadly laminar sinuous dorsal typhlosole commencing in XXVII. Nephridia : a pair of very large meronephric tufts in V at the anterior limit of the gizzard send a composite duct forward, on each side, into II in the vicinity of the buccal cavity into which it probably opens. Paired tufts in VI-XIV diminish to virtually simple nephridia in XIV ; each sending a long (composite ?) duct on each side to the ventral body wall at which it appears to fan out as a diaphanous membranous structure ; no other nephridia present in these segments. In XV-XIX there are transverse bands of bushy, apparently astomate (exonephric ?) micromeronephridia at the anterior border of each segment but in XX these are augmented by parietal bands at the posterior border and the median nephridium is greatly enlarged, traversing the entire width of the segment, as a megameronephridium ; a preseptal funnel is demonstrable for the anterior-most and many subsequent megameronephridia ; a slender duct demonstrable in the anterior intestinal region and caudally running from each megameronephridium to the roof of the intestine beneath the dorsal vessel. Metandric ; testes and iridescent funnels in XI and large racemose seminal vesicles in XII ; testis-sacs absent. Ovaries as flattened lobes with a fringe of terminal oocytes, and funnels, in XIII ; lobulated structures in XIV are presumably ovisacs. Prostates a pair, with large flattened glands in XVIII and XIX which are superficially lobulated and incised but appear resolvable into an S-shape ; with tortuous moderately long muscular ectal duct joined at the gland by the vas deferens. Spermathecae 2 pairs, in VIII and IX, each with bulbous ampulla and narrowly tapering sinuous duct ; 2 ellipsoidal inseminated diverticula joining the ental end of each duct, one on each side ; the ducts in VIII and IX entering the body wall immediately behind setae *a*.

Material examined : Stn 5-2 (Paris Museum AH 338 (illustrated) — AH 339 ; 3 BJ 1976. 5.11, 14, 15).

Type locality : Tiger Shola (near Kodaikanal), Palni Hills.

Remarks

The above description confirms location of both pairs of spermathecal pores behind the setal arcs of their respective segments, a location questioned by Gates (1938). The genital marking lateral to the male pore was absent from the single type-specimen but its occurrence is not constant and does not require taxonomic recognition.

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